United States
Environmental Protection
Agency

Office of Research and
Development
Washington, DC 20460

Office of Solid Waste and
Emergency Response
Washington, DC 20460

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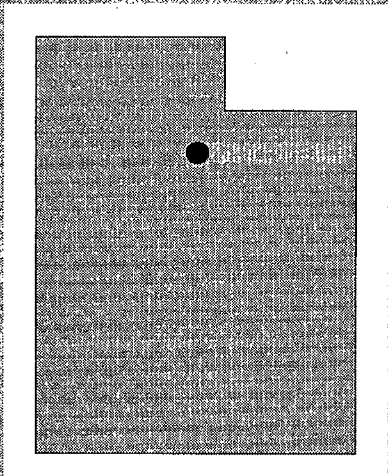
EPA

Bioremediation Field Initiative Site Profile:
Hill Air Force Base Superfund Site

SITE FACTS



Location: Salt Lake City, Utah

Laboratories/Agencies: U.S. Air Force, U.S. EPA Risk Reduction Engineering Laboratory (RREL), U.S. EPA Region 8

Media and Contaminants: JP-4 jet fuel in unsaturated soil

Treatment: Bioventing

Date of Initiative Selection: Spring 1991

Objective: To evaluate the effectiveness of bioventing jet fuel in deep vadose zone soil

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Background

Hill Air Force Base (AFB) near Salt Lake City, Utah, is the site for one of two projects the Bioremediation Field Initiative is undertaking in cooperation with the U.S. EPA Risk Reduction Engineering Laboratory (RREL) and the U.S. Air Force to biovent JP-4 jet fuel spills. The other, at Eielson Air Force Base in Alaska, is described in a separate fact sheet.

Bioventing is the process of supplying oxygen in situ to oxygen-deprived soil microbes by forcing air through contaminated soil at low airflow rates. Because bioventing equipment is relatively noninvasive, this technology is especially valuable for treating contaminated soils at military bases, industrial complexes, and gas stations, where structures and utilities cannot be disturbed.

At Hill AFB, the objectives of the Initiative are to gain experience in bioventing large volumes of soil and determine the effect of airflow rate on biodegradation and volatilization rates. The challenges at this site are (1) to biodegrade contamination that extends deep beneath the surface and (2) to biovent the fuel plume under roads, underground utilities, and buildings.

Characterization

The Hill AFB site is contaminated with JP-4 fuel from a depth of approximately 35 ft to the ground water, which occurs at 95 ft below the surface. The contaminated soil is a mixture of sand, silty sand, and sand interspersed with gravel and clay. Soil samples taken in September 1991 revealed an average total petroleum hydrocarbon (TPH) level of 890 mg/kg, ranging up to 5,000 mg/kg at certain depths. Ground water samples showed an average TPH concentration of 1.5 mg/L, with TPH concentrations in some wells as high as 10 mg/L. The contaminated area extends beneath a tool maintenance building, engine storage yard, and fuel storage yard (see Figure 1).

Field Evaluation

Bioventing performance is being evaluated at three different air injection rates. Unlike soil venting or soil vacuum extraction technologies,

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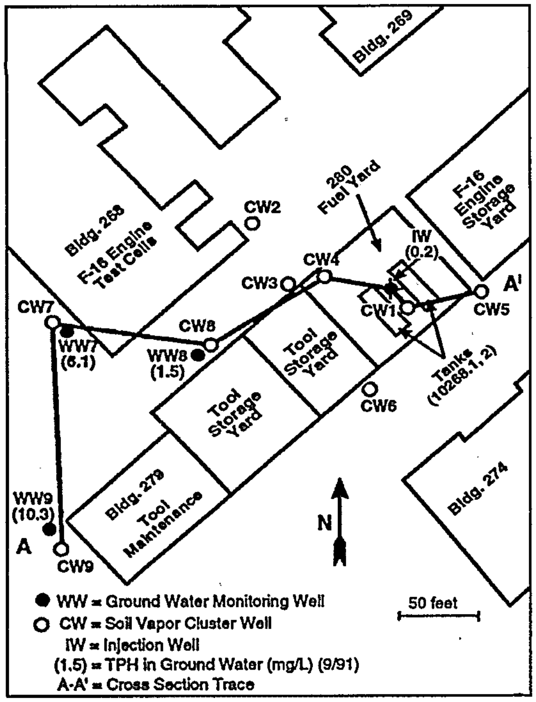

Figure 1. Plan view of contaminated area.

bioventing uses low airflow rates to stimulate biodegradative activity while minimizing volatilization of contaminants in the soil. Higher air injection rates stimulate faster and more widespread biodegradation but also release more volatile emissions to the surface. Figure 2 shows an air injection well at the site. Twice a year, the rate of air injection is reduced to study the tradeoff between the loss in area of influence of the injected air for bioremediation and the decrease in volatilization of organics at the soil surface.

To determine the rate of hydrocarbon loss due to bioventing, RREL conducts semiannual in situ respiration tests. Air injection is shut off for 4 to 8 days, during which soil gas oxygen levels are carefully monitored. The rate of oxygen uptake by microorganisms in the contaminated soil, relative to oxygen loss observed in an uncontaminated area, indicates the rate of biodegradation.

RREL has conducted an inert gas tracer study to determine the transport of gas through the soil. During this study, researchers temporarily injected helium instead of air into the vent well. By monitoring for the inert gas at the various soil gas wells, researchers determined how efficiently the injection well delivers air to the soil.

Status

The U.S. Air Force began bioventing operations in January 1991. Between July and September 1991, RREL installed additional wells to monitor bioremediation performance over the entire 100-ft depth of the contaminated vadose zone. The first flow rate change and in situ respiration test, and the inert gas tracer study took place in fall of 1992. Final soil hydrocarbon analyses will be conducted in summer of 1993. These results will be compared with the initial soil analysis to document overall hydrocarbon loss due to bioventing.

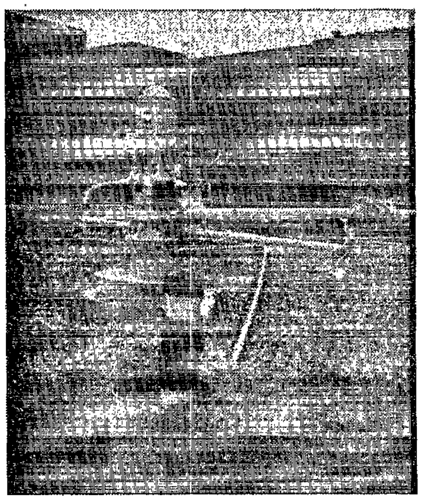

Figure 2. Air injection well at the surface.

The Bioremediation Field Initiative was established in 1990 to expand the nation's field experience in bioremediation technologies. The Initiative's objectives are to more fully document the performance of full-scale applications of bioremediation; provide technical assistance to regional and state site managers; and provide information on treatability studies, design, and operation of bioremediation projects. The Initiative currently is performing field evaluations of bioremediation at eight other hazardous waste sites: Libby Ground Water Superfund site, Libby, MT; Park City Pipeline, Park City, KS; Bendix Corporation/Allied Automotive Superfund site, St. Joseph, MI; West KL Avenue Landfill Superfund site, Kalamazoo, MI; Eielson Air Force Base Superfund site, Fairbanks, AK; Escambia Wood Preserving Site—Brookhaven, Brookhaven, MS; Reilly Tar and Chemical Corporation Superfund site, St. Louis Park, MN; and Public Service Company, Denver, CO. To obtain profiles on these additional sites or to be added to the Initiative's mailing list, call 513-569-7562. For further information on the Bioremediation Field Initiative, contact Fran Kremer, Coordinator, Bioremediation Field Initiative, U.S. EPA, Office of Research and Development, 26 West Martin Luther King Drive, Cincinnati, OH 45268; or Michael Forlini, U.S. EPA, Technology Innovation Office, Office of Solid Waste and Emergency Response, 401 M Street, SW., Washington, DC 20460.